

should be scraped in order to ensure that all material is experiencing consistent grinding. At the completion of grinding, or during testing in the lunar environment, a portion of the activated material will be added to a solution consisting of disodium terephthalate diluted in phosphate-buffered saline (PBS) at a concentration of 10 mM. The concentra-

tion of the sample in solution should be at least 1 mg/mL in order to provide sufficient fluorescence intensity. After allowing the sample to interact with the solution for 30 minutes, the mixture will be filtered using a 0.2-micron filter. The filtered solution will be placed in the quartz cuvette, and emission spectra will be obtained using an excitation wave-

length of approximately 324 nm. The emission spectra will be compared to the calibration curve made using pure 2-hydroxyterephthalate.

*This work was done by William T. Wallace of Universities Space Research Association and Antony S. Jeevarajan of Johnson Space Center. Further information is contained in a TSP (see page 1). MSC-24446-1*

## Aperture Ion Source

**The aperture ion source has application in commercial mass spectrometers.**

*Goddard Space Flight Center, Greenbelt, Maryland*

The aperture ion source was conceived to eliminate distortion in measurements of angular distributions of neutral atoms and molecules that require electron-impact ion sources. The approach simplifies the coupling between ion source and spectrometer while providing virtually distortion-free angular distributions and improved accuracy in the dimensions of the ionization region. Furthermore, it virtually eliminates the volume occupied by the ion source.

The basic idea is to place the ionization region in the aperture to the energy-angle analyzer or mass spectrometer. Electron impact ionization of neutrals prior to analysis is used here as in conventional ion sources. Implementation of the idea embeds the ionizing electrons in a very narrow space immediately above the spectrometer entrance aperture, leading to improved performance over the present extended ion source configuration. In order to ensure a field-free ionization volume, the ionization space is defined by two plates with identical apertures, the central plane between the two serving as the object plane for the spectrometer. Therefore, the effective position of the en-

trance aperture to the spectrometer lies in the middle of the ionization region. One of the goals is to provide an easy way to specify the position and dimensions of the ionization region. Thus, the smaller the ionization region, the easier the specification of the ionization region, and if done properly, the smaller the fraction of unused electrons in the electron beam. Making the ionization region as small as possible should also enhance ionization efficiency. This is actually borne out by a calculation comparing the ionization efficiencies of the present scheme to that of the aperture ion source.

The aperture ion source would operate as follows. One of the four cathodes is activated to emit ionizing electrons toward the ionization region. A collector just ahead of the diametrically opposite unused cathode registers the ionizing electron current. A fraction of the neutral atoms and molecules passing through the apertures is ionized and proceeds on to the interior of an energy-analyzer to give the energy-angle distribution of the original neutrals.

In addition to simplifying and enabling distortion-free measurement of

angular distributions of neutral atoms and molecules, this innovation offers a drastic reduction in ion source volume with improvements in ionization efficiency. This innovation also lends itself to mounting two, four, and possibly eight cathodes around the aperture to provide two, four, and eight-fold redundancy to improve reliability.

The formulation process of this idea showed that the aperture ion source offers higher efficiency over conventional ion sources that ionize the neutral gas at some distance from the entrance aperture of the spectrometer. In addition, it offers well-defined ionization volume for careful quantitative analysis using mass spectrometers. Most commercial mass spectrometers use such electron impact ionization ion sources with issues of operation downtime due to cathode replacement. The cathode redundancy that comes with this innovation would reduce downtime by at least a factor of four.

*This work was done by Fred Herrero of Goddard Space Flight Center. Further information is contained in a TSP (see page 1). GSC-16145-1*